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Teachers' Belief and Use of Interactive Whiteboards for Teaching and Learning

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ABSTRACT

Interactive whiteboards (IWB) are regarded as one of the most revolutionary instructional technologies for various educational levels. While the impacts of IWBs in classroom settings have been examined recently in a number of studies, this study not only looks at the perception but also examines the actual usage and behaviors associated with promising IWB features in practical settings. The main goal of this paper is to evaluate both teachers' perceptions and their use of IWBs. A questionnaire was developed based on an extensive literature review as well as related instructional theories and models. The questionnaire consisted of questions about demographics, usage, and teachers' perceptions related to IWBs. For this study, 174 teacher-participants, who have actively used IWBs for instruction, were selected from various educational levels (from grade 6 to 12). The results show that teachers believe that IWBs can be used for different subject domains. Also, teachers believe that IWBs can be used to facilitate learning and instruction under the following conditions, 1) collaboration with colleagues, 2) training about effective instructional strategies using IWB, and 3) more frequent teacher use of IWBs to improve IWB competency.

Keywords

Interactive whiteboard, Interactive whiteboard teacher scale, Interactive learning environments, Secondary education, Technology acceptance model, Technology integration, Technology adoption

Introduction

Educational institutions have tried to provide students better learning environments by equipping them with the latest technology. This effort has encouraged instructors to use various assistive technologies such as computers and the Internet in their classrooms especially over the last decade; this process is called integration of information and communication technologies (ICT) (Hsu, 2010). As a part of the ICT integration process, the interactive whiteboard (IWB) has been one technology most invested in especially by European countries such as England, Spain, and Turkey (Holmes, 2009; Türel, 2010). As of 2010, England has the highest IWB penetration rate (73%) in the world and many countries including Denmark (50%) and the USA (35%) have substantially increased IWB rates in classrooms; however, the average rate for Asia is still lower than 2% according to a recent research report (McIntyre-Brown, 2011).

IWB's promising benefits to learning and instruction have led to its increased popularity and attractiveness as expressed by a number of researchers (Bell, 2002; Levy, 2002; BECTA, 2003; Brown, 2003; Beauchamp & Parkinson, 2005; Smith, Higgins, Wall, & Miller, 2005; Slay, Siebörger, & Hodgkinson-Williams, 2008). It is asserted that IWBs can enhance the functionality of existing ICT such as computers and projectors by adding interactivity to these media that make it distinct from traditional PowerPoint presentations (Hall & Higgins, 2005; Smith et al., 2005; Torff & Tirotta, 2010). Considering the possible advantages of IWBs, teachers can enrich their instructions with various instructional strategies and techniques and, therefore, increase students' attention, motivation, participation, and collaboration by means of an IWB (Levy, 2002; Beauchamp & Parkinson, 2005; Hall & Higgins, 2005; Glover, Miller, Averis, & Door, 2007). Although those researchers strongly emphasize the positive effects of this technology when appropriately integrated into classrooms, the true success of IWBs depends on how they have been used by teachers in a learning context. Teachers report that they have used IWBs through appropriate instructional strategies and resources, and above all, learned to incorporate the IWB with their course content. Hence, researchers, who have attempted to evaluate IWB use, have relied on perceptions of teachers as the main data source (Slay, Siebörger, & Hodgkinson-Williams, 2008), to determine the effectiveness of this technology in school settings.

Instructional use of interactive whiteboards

The interactive whiteboard (IWB) has been used in many contexts in various ways. Effective use of IWBs in classrooms promises numerous advantages in terms of learning and instruction (Türel, 2010). However, to better

understand how we can effectively use IWBs in classrooms, several questions should be considered: What instructional strategies can teachers use with IWBs and what kinds of benefits do IWBs have on teaching and learning.

Successful instruction may be a result of various IWB features along with sound instructional strategies (Brown, 2003; Glover et al., 2007). Teachers can put a variety of strategies and techniques into practice using IWBs by considering the characteristics of the learning context including students' needs and interests, and technical facilities (Türel, 2010). Several IWB instructional strategies that have a positive effect on student learning include:

- Highlighting, coloring, or annotating important content (Türel & Demirli, 2010)
- Flipping back and forth to review previous content providing reviewing techniques better understanding (Levy, 2002; Smith et al., 2005)
- Using pictures for discussion and brainstorming, collaborative writing, shared reading, peer-teaching, and collaborative problem solving (BECTA, 2006)
- Hiding and reveal, drag and drop, and matching items activities (Türel, 2010)
- Observing different media—essential for visual learners (Bell, 2002)
- Touching and feeling the material—good for tactile learners (Bell, 2002)
- Accommodating lower ability and special needs—zoom feature for visually impaired students (Smith, 2008)
- Presenting ideas and reflections about the course content
- Finding hidden part of a picture with spotlight or screen-shade (Beauchamp & Parkinson, 2005)
- Capturing screenshots from web pages synchronously and manipulating them
- Correcting mistakes in the materials (Beauchamp & Parkinson, 2005)
- Playing games (Smith et al., 2005)

Benefits of IWB technology include:

- Enhanced social interaction (Türel & Demirli, 2010)
- Reformed learning environments—teachers may facilitate student's involvement, interaction, and collaboration (Smith et al., 2005)
- Draw the learners' attention (Türel, 2010)
- Facilitated learning and remembering using visual media (Türel, 2010).
- Enlarged computer touch screen
- Interactions can be recorded and saved—Acrobat (PDF) document, PowerPoint slides, or record whole lecture as a movie file
- Using with voting systems, document cameras, and electronic microscopes (Bell, 2002)

To this end, as well as having IWB technical competencies and skills, teachers should also be aware of such pedagogical implications in order to provide effective instruction to their students using IWBs (Türel, 2010). Although research suggest that an ideal use of IWBs may have a positive impact on learning and instruction, it is important to investigate how teachers in classroom settings are using IWBs.

In order to better understand teachers' IWB use, the examination of different factors is needed such as time, instructional strategies, and techniques. Depending on the frequency and duration of IWB use, teachers gradually develop their skills and abilities (Hodge & Anderson, 2007). However, overuse of IWBs as a presentation tool in a teacher-led instructional setting may deteriorate students' motivation, attention, and consequently, the efficiency of instruction (Hall & Higgins, 2005).

Results of studies in various contexts such as different countries, across educational levels, and subject domains, demonstrate teachers' positive perceptions about IWBs (Slay, Siebörger, & Hodgkinson-Williams, 2008). However, in some studies, teachers reported several IWB issues that may dramatically decrease the effectiveness of IWBs in their courses (Somyürek, Atasoy, & Özdemir, 2009). As a crucial issue, many studies (Levy, 2002; BECTA, 2003; Smith et al., 2005) address teachers' insufficient IWB knowledge and experiences. One solution is to provide in-service training focusing on effective IWB strategies. Several studies (Glover & Miller, 2001; Smith et al., 2005) stress that teachers often get limited IWB training from suppliers that only covers basic IWB skills. Likewise,

teachers may improve their IWB skills by themselves or by collaborating with colleagues (Shenton & Pagett, 2007). Providing an appropriate training program depends on the assessment of needs, problems, expectations, and skill levels of IWB users. To this end, Beauchamp (2004) developed a framework that classifies IWB users based on behaviors and features most often used. Beginners use IWBs as a traditional blackboard, while advanced users use IWBs to construct meaning using interactive and fluid lesson strategies. Technical competencies are examined looking at navigating an operation system, importing media from different sources, properly using hyperlinks between programs, and regularly saving lessons (Beauchamp, 2004). Based on this framework, it was found that higher-level experienced teachers use more IWB features.

Similar to this correlation, increasing use of technology is strongly correlated to teachers' acceptance and positive attitudes about the technology. Thus, the duration or frequency of teachers' IWB use is regarded as another correlating factor that may impact teachers' perceptions about IWBs. However, it is impossible to measure the exact IWB exposure time during instruction due to the variety of IWB techniques that teachers use. Some strategies only use IWBs while others incorporate a combination of techniques such as IWB with group discussions for example. Even within an IWB focused strategy, teachers may use lecture and also demonstration along with drill and practice. As such, exposure time had a relative effect because teachers use IWBs for different purposes (Levy, 2002). In addition, the amount of elapsed time of IWB use based on hours in a week (e.g., Erduran & Tataroğlu, 2009) may be misleading because the total hours some teachers work in a week may vary. Thus, Moss et al. (2007) examined the frequencies of teachers' IWB use under the following categories: never, hardly ever, some, most, and every lesson. They found no significant differences between Mathematics, Science, and English teachers in terms of the frequency of IWB use. However, in reducing the frequencies to low and high IWB use, Moss et al. (2007) found that math teachers in the high IWB use group revealed stronger positive attitudes towards IWBs than the low IWB use group.

Significance of the study

In many studies (e.g., Bell. 1998; Beeland, 2002; Cogill, 2002; Levy, 2002; Beauchamp, 2004; Wall, Higgins, & Smith, 2005; Moss et al., 2007), teachers' preferences, needs and perceptions about IWBs have been examined to better understand how these factors impact IWB use. The majority of those studies investigated teachers' perceptions by means of questionnaires focusing on particular variables such as attitudes (Beeland, 2002), motivation (Wall, Higgins, & Smith, 2005; Torff & Tirotta, 2010), satisfaction (Bell, 1998), interaction (Levy, 2002; Glover et al., 2007), acceptances (Saltan, Arslan, & Gök, 2010), and technical issues of IWB use (Wall, Higgins, & Smith, 2005; Somyürek, Atasoy, & Özdemir, 2009).

In addition to perceptions, current practices need to be measured and analyzed to best understand teachers' technology use. In the literature, it seems there are several paucities and limitations regarding overall IWB evaluation since they are primarily based on teachers' perceptions. Some studies only focused on a specific discipline area (e.g., Glover et al., 2007) while others have a limited sample size (e.g., Bell, 1998; Beeland, 2002; Tozcu, 2008). Additionally, teacher-participants who have not used or have just started to use IWBs in their classes may be an inappropriate data source for an evaluation of perceptions because of their insufficient knowledge, experience, and attitudes about the use of IWBs. Another critical issue for IWB research is the use of appropriate surveys and questionnaires that were developed based on existing research as well as sound instructional theories and strategies associated with the use of IWBs. Addressing the issues regarding the evaluation of IWB use, we conducted this study by means of an original instrument on a particular group of IWB-experienced teachers who were teaching at different educational levels and various disciplines in Turkey.

Bearing in mind the increase of IWB technology investments, there is a strong need for the evaluation and thus, improvement of actual IWB use in schools (Slay, Siebörger, & Hodgkinson-Williams, 2008). Considering the importance of teachers' perceptions, attitudes and beliefs about IWB use, this study focuses on the multiple component investigation of IWBs based on teachers' perceptions on their current IWB use including frequencies of usage, preferred IWB features, status quo of IWB skills and training as well as perceptual benefits of IWB in classroom teaching and learning. Based on the purpose of this study, the research questions are as follows:

1. What are the main sources of IWB training for teachers?
2. What IWB training topics do teachers need?
3. How much is each IWB feature being used?
4. What are the teachers' perceptions about their IWB use?

5. Is there a relationship between teachers' IWB use frequencies and 1) self-reported competencies, 2) discipline areas, and 3) teachers perceptions?

Method

For this study, a quantitative descriptive research method was employed to investigate the perceptions of teachers regarding the current state of IWB use in schools. Descriptive research methods are one of the most preferred and effective methods to depict and interpret the understanding of participants' beliefs about a certain issue or phenomenon (Gall, Gall, & Borg, 2003). Given that we needed to collect data from many people, it was out of scope for this study to visit each class and observe the use of IWB for each teacher. The potential for self-report bias was minimized since the data was anonymous and was not shared with anyone who directly knew the participants (Chan, 2009). Data was collected from teachers via a questionnaire developed specifically for this study.

Participants

The sample for this study consisted of 174 Turkish teachers, ranging from grades six to twelve, who have actively used IWBs for at least six months in their schools. We selected the volunteer participants based on the purposeful and convenience sampling method. Since the focus of this study is to evaluate how teachers use IWBs rather than why teachers do not use IWBs, it was essential to select participants among ones who have had sufficient knowledge of and experience with IWBs and also were familiar with the issues of IWBs in practice. All participants were college educated and 59.8% of them were male. The majority of participants were less than 36 years old (90.8%) and the majority of all the teachers (88.5%) had been teaching for less than ten years. Teachers' responses were examined in terms of their fields of teaching by categorizing them into six areas: Computer Science, Foreign Language (English), Mathematics, Science, Social Sciences, and Turkish Language and Literature.

Instrument Development

In order to create a questionnaire consistent with the study's purpose, we examined current studies looking at instructional theories and strategies, current practices, problems and perceptions of IWB users (Bell, 1998; Beeland, 2002; Cogill, 2002; Beauchamp, 2004; Wall, Higgins, & Smith, 2005; Moss et al., 2007). The initial draft of the questionnaire was distributed for feedback from 10 teachers who were active IWB users across various subject areas, two instructional designers, two language teachers, and two educational science teachers. Revisions were made based on expert opinions. This step was vital to achieve a comprehensible and relevant questionnaire in terms of face and content validity (Black & Champion, 1976).

As well as demographics and multiple-choices items, the final questionnaire ($\alpha = .93$) included 26 Likert scale items from strongly disagree to strongly agree. We also classified the Likert scale items along with the existing literature into themes to provide a better understanding of main dimensions of IWB use. Those themes are labeled as instructional effects of IWBs ($\alpha = .86$), motivational effects of IWBs ($\alpha = .89$), and the usability of IWBs ($\alpha = .60$). The first theme includes items related to effects of IWBs on teaching and learning while the second theme has items addressing the motivational issues of IWBs. The last theme includes three items concerning the usability of IWBs. Original language of the paper-based questionnaire delivered for this study is Turkish.

Analysis

Considering the goals for the study, a descriptive analysis was performed to understand the current state of teachers' IWB use as well as teachers' general perceptions about using IWBs. To provide a clear picture, percentages of teachers' agreement levels are presented in two groups: agreeing (agree and strongly agree options), and disagreeing (disagree and strongly disagree options). For internal consistency and reliability, Cronbach's Alpha coefficients were calculated and interpreted for each theme based on the rules (.9 = high level, .8 = moderate, .7 = low level, .6 = acceptable level, and <.6 = unacceptable level) (Murphy & Davidshofer, 1991).

Chi-square tests of independence were performed to analyze the relationships of key categorical variables such as the frequency and duration of IWB use with teachers' fields, IWB competencies, and their perceptions. Cramer's V-values were examined for the effect size of associations in accordance with the intervals presented by Kotrlik and Williams (2003).

Results

Results for the study are presented in three parts: 1) statistical results of teachers' IWB use, skills, and training, 2) descriptive results of teachers' responses to the questionnaire items, 3) results focusing on individual differences between IWB usages and perceptions.

Teachers' IWB use and training

In the first section of the IWB questionnaire, teachers were asked several questions about their use of IWBs in their courses (see Table 1).

Table 1. Teachers' IWB usage statistics

		Frequency	Percent (%)
How long have you used an IWB (number of year)?	Less than 1 year	45	25.9
	1-3 year	118	67.8
	More than 3 year	11	6.3
How many hours do you use IWBs in a week?	< 3 hour	25	14.4
	4-5	26	14.9
	6-7	16	9.2
	> 7 hours	107	61.5
Frequency of IWB use	Sometimes	36	20.7
	Frequently	74	42.5
	Always	64	36.8
How competent you are as an IWB user?	1 (incompetent)	8	4.6
	2	11	6.3
	3	68	39.1
	4	79	45.4
	5 (professional)	8	4.6

All participants stated that they had a portable IWB (Mimio or E-beam) in their classrooms. A small number of teachers (5.2%) reported using IWBs less than one hour per week while the majority of teachers (61.5%) reported using IWBs more than seven hours per week. When asked to select one of three levels for their IWB use (sometimes, frequently, or always), teachers mostly selected either 'frequently' (42.5%) or 'always' (36.8%) while 'sometimes' had the lowest rate (20.7%). Using an IWB skills level framework (Beauchamp, 2004), teachers graded themselves as IWB users from incompetent (1) to professional (5). The majority of teachers described themselves as either average (39.1%) or just above average (45.4%) levels while a few teachers acknowledged themselves as either professional (4.6%) or incompetent user (4.6%).

The relationships of key categorical variables were analyzed such as the frequency and duration of IWB use with teachers' fields, IWB competencies, and teachers' perceptions. Teachers who did not use IWBs were not included in this study. Chi-square tests showed significant results in the association of IWB use frequencies 1) with teachers' self-reported IWB competencies [χ^2 (8, N = 174) = 47.43, $p < 0.05$, Cramer's V=.369] and 2) with their discipline areas [χ^2 (10, N = 174) = 34.86, $p < 0.05$, Cramer's V=.317]. For the distribution of weekly hours indicating the duration of IWB usage, chi-square tests were performed for two levels (up to seven hours, more than seven hours). Similar to the results of usage frequencies, significant differences were found between 1) the duration of weekly IWB use and teachers' IWB competencies [χ^2 (4, N = 174) = 16.56, $p < 0.05$, Cramer's V=.309] as well as 2) teachers' discipline areas [χ^2 (5, N = 174) = 24.92, $p < 0.05$, Cramer's V=.378]. These results show that there are positive correlations between the increase on the IWB usage and IWB competencies. Also, there is a positive

correlation between teachers' IWB usages and their fields. All significant relationships demonstrate a moderate association based on the interpretation of Cramer's *V*-values between 0.2 and 0.4 (Kotrlik & Williams, 2003).

A multiple-selection question was used to determine how teachers use the most prominent IWB features. Teachers could select any feature for this question with two options: seldom and frequently (see Figure 1).

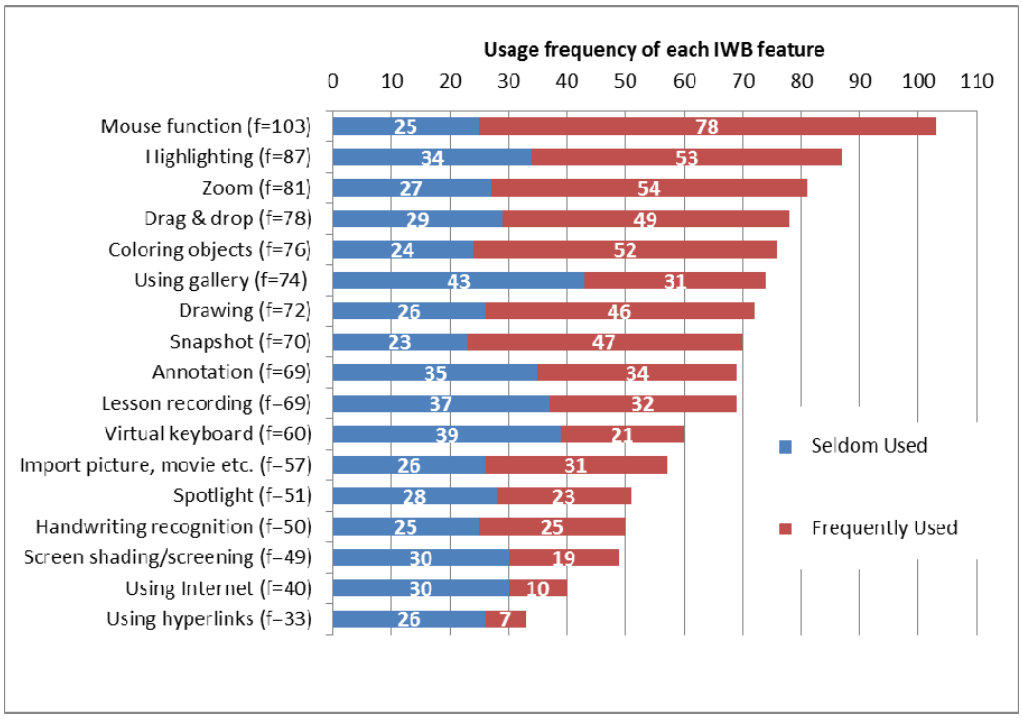

Figure 1. Usage frequencies of IWB features

The results show how often the features are used as well as total frequencies. Participants most commonly use IWB's mouse function while the fewest number of teachers (N=33) used hyperlinks.

Teachers were asked about how they obtained their IWB skills and knowledge. Four options were posed to teachers and they were instructed to select up to two options (Figure 2). Restraining the options was designed to extract the most important training sources for teachers.

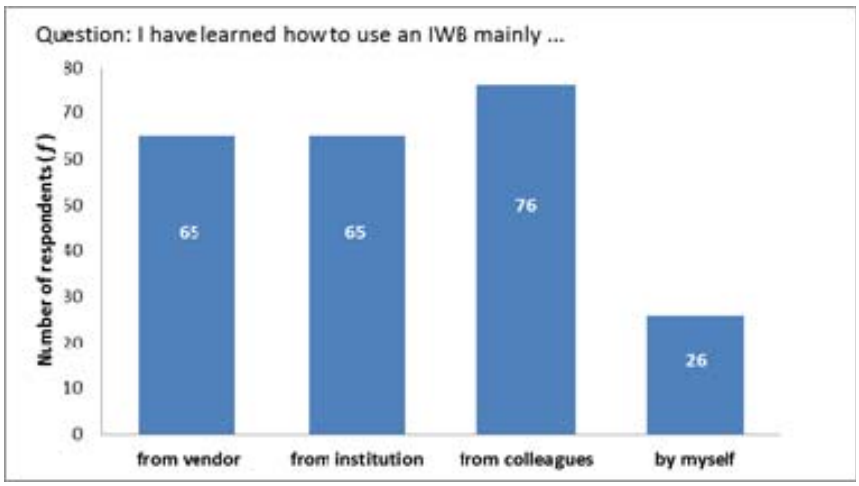

Figure 2. Main sources of IWB training for teachers

Results show that while 164 respondents marked at least one option to this question, 90 (55%) respondents reported that they received training from either their own institutions or the vendor of the IWB while 20 (12%) responded that they were trained by both sources. In addition, 76 respondents reported that they learned to use IWBs from their colleagues while 26 teachers reported that they learned using IWBs by themselves.

Given three main IWB topic categories, teachers were asked about what IWB training topics they had taken, what topics were needed, or what topic they did not need to take. The topics included (1) technical IWB information and skills, (2) effective teaching methods and techniques for an effective IWB use, and (3) finding and designing instructional materials compatible with IWBs (Figure 3).

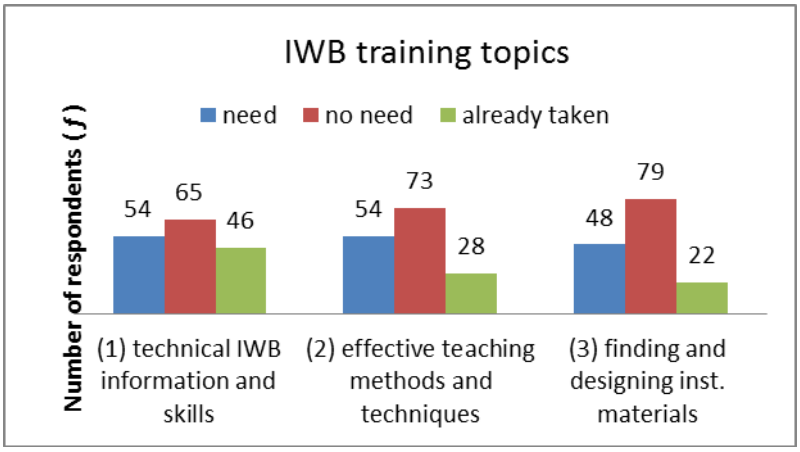

Figure 3. Needs for IWB training in regard to three main topics

The results show that there are a large number of teachers that say that they do not need to take training related to the topics.

Teachers' Responses to the Questionnaire Items

The results of teachers' responses to the 26 Likert-scale items in the questionnaire were examined according to three main themes: (a) instructional effects of IWBs, (b) motivational effects of IWBs, (c) the usability of IWBs.

Instructional Effects of IWBs

Teachers responded to the questions related to the instructional effects of the IWB use on teaching and learning (Table 2). Cronbach's alpha coefficient for this part of the questionnaire is 0.86.

Table 2. Instructional effects of IWB use

				% of teachers disagreeing/ agreeing with each statement	
Statements	N	Mean	SD	Disagree	Agree
In terms of teaching					
Q1. IWB helps me to manage instructional time effectively	172	4.27	.943	5.8	82.6
Q2. I think the lessons become more effective with IWB	168	3.90	1.010	10.1	69.6
Q3. IWB facilitates the classroom management for me	158	3.77	.944	9.5	68.4
Q4. IWB helps my lessons be more interactive	157	3.82	.859	7.6	70.1
Q5. IWB facilitates discussions on the content in class	158	3.30	.954	17.7	41.8
Q6. There is no time for my students to get around to using an IWB*	162	2.99	1.098	37.0	34.6

Q7. IWB provides advantages to me to make course content more visual	162	4.41	.701	1.9	91.4
Q8. The way I give instruction has been changed since I began to use an IWB	172	3.45	1.011	16.9	49.4
Q9. IWB helps me to use the computer and projector more effectively than before	163	4.12	.837	10	82.8
In terms of learning					
Q10. I believe using an IWB helps my students' learning	174	4.16	.904	2.9	77.0
Q11. Using an IWB makes it easier for my students to remember what they learned in class	161	3.73	.908	11.2	64.0
Q12. My students learn faster when I teach with an IWB	159	3.78	1.017	11.3	65.4
Q13. IWB helps my students to learn in groups	157	3.57	.975	14.0	58.0
Q14 Using an IWB helps students to learn concepts easier	156	3.79	.878	8.3	69.9

* This negative statement was reverse-coded

Motivational effects of IWBs

Teachers' general attitudes and opinions related to IWB use were examined for motivational effects of IWBs in terms of either teachers or students (Table 3). Cronbach's alpha coefficient for this part of the questionnaire is 0.89.

Table 3. Motivational effects of IWB use

				% of teachers disagreeing/ agreeing with each statement	
Statements	N	Mean	SD	Disagree	Agree
In terms of teacher					
Q15. I enjoy teaching with an IWB	172	3.97	.936	7.0	70.3
Q16. Because of using an IWB, I feel myself more prepared for instruction	162	3.73	1.002	11.7	67.9
Q17. I notice my IWB skills are improving day by day	162	3.90	.861	7.4	75.9
Q18. Learning how to use an IWB is essential to me	160	4.06	.856	5.6	81.3
Q19. IWB makes my courses more enjoyable	161	3.83	.875	7.5	67.1
In terms of students					
Q20. Using IWB increases my students' interest in class	161	3.98	.877	4.3	75.2
Q21. My students look forward to my using an IWB in class	157	3.08	1.074	29.9	31.8
Q22. My students focus on my lessons more when I use an IWB	161	3.74	.925	8.7	64.0
Q23. IWB increases my students' motivation towards the course	160	3.84	.843	6.3	70.0

Usability of IWBs

In order to examine the usability of IWBs, teachers were asked to respond to three statements (Table 4). Cronbach's alpha coefficient for this group of questions is 0.60.

Table 4. Usability of IWBs

				% of teachers disagreeing/ agreeing with each statement	
Statements	N	Mean	SD	Disagree	Agree
Usability of IWBs					

Q24. IWB can be used in all kinds of courses	172	3.90	1.080	12.2	64.5
Q25. My course content is not suitable with using an IWB*	170	3.79	1.067	14.7	67.1
Q26. IWB can be used with various instructional methods and techniques	157	3.95	.830	3.8	74.5

* This negative statement was reverse-coded

Relationship between Teachers' IWB usage and perceptions

Chi-square tests were administered in order to examine whether there are any differences between teachers' perceptions in terms of the frequency and duration of their IWB use. Comparisons of individual differences in terms of the IWB use frequencies and also duration of IWB use on a weekly basis and perceptions about IWB use were analyzed by means of the chi-square test of independence. The results of the tests and effect size values (Cramer's V) for each significant relation are presented in Table 5.

Table 5. Chi-square test results for IWB use and perceptions of teachers

	Items	Q4*	Q7*	Q11	Q17	Q24	Q28	Q39	Q52
Frequency of IWB use (sometimes, frequently, always)	$\chi 2$ (df)	18.92(8)	26.35(8)	18.13(8)	14.37(6)	18.66(8)	16.80(8)	15.58(8)	32.12(6)
	Cramer's *V*	.235	.277	.232	.210	.240	.228	.221	.315
	Items	Q3	Q4	Q7	Q27	Q28	Q33	Q39	Q52
Duration of weekly IWB use (up to 7 hours, more than 7 hours)	$\chi 2$ (df)	10.24(4)	10.07(4)	12.07(4)	8.10(3)	9.92(4)	10.80(4)	13.06(4)	11.32(3)
	Cramer's *V*	.244	.242	.265	.224	.248	.262	.287	.264

As shown in Table 5, both frequency and duration of the IWB use moderately effect (Cramer's *V* between 0.2 and 0.4) teachers' perceptions in terms of the items presented above. In addition, we found significant results for three items (Q28, Q39, and Q52) in terms of both frequency and duration of the IWB use.

Discussion

Teachers' IWB use and IWB training characteristics were somewhat strong. Since all participants were selected based on their prior experience with IWB use, it is not a surprise that a high percentage (79.3%) reported that they had 'frequently' or 'always' used IWBs in their courses. However, only half of them defined their IWB competencies above average. Although these findings give the sense about the high quantity of IWB use specifically for this sample, teachers were questioned on how they used IWBs in their classes and also what IWB features they used. The results regarding preferred features of IWBs were in parallel with the results of a previous study conducted by Türel (2011), which examined students' perceptions about IWB use in Turkey. While teachers reported they used a wide range of IWB features, it is clear that several features including Internet and hyperlinks are the least preferred. For example, Beauchamp and Parkinson (2005) defined using hyperlinks as one of the highest levels of IWB skills according to the IWB progression levels. The data (see Figure 1) depicts the paucity of synergistic (professional) users based on the less utilized features and also the majority of initiate and advanced users based on Beauchamp's (2004) framework, was consistent with the teachers' self-reported competencies (see Table 1).

The main sources of teachers' IWB training showed the majority of respondents (67%) had joined an IWB training session organized either by the company that supplies IWBs or by an educational institution. Looking at learning resources, almost half of the respondents (44%) marked 'colleagues' as the main resource for their support and while about a quarter of respondents reported that they learned to use IWBs by themselves. Shenton and Pagett (2007), who observed IWB users in the UK schools, suggest that their teacher-participants gained skills to use IWBs working by themselves or with a group of teachers. As such, these two sources should be considered as essential supports for teachers' IWB use as well as for informal IWB training.

Teachers' ratings for the three IWB-training themes surprisingly indicated that most of them do not need IWB training related to finding and designing instructional materials for the IWB although only 22 teachers received

training regarding this topic. This result may stem from teachers' learning IWB on their own. However, one third of all participants still reported that they need IWB training in each one of the three areas: IWB technical knowledge and skills; teaching methods related to IWB; and designing IWB activities. This finding is broadly in line with the results of several studies (Glover & Miller, 2001; Smith et al., 2005; Somyürek, Atasoy, & Özdemir, 2009).

Effects of Interactive Whiteboards

Teachers' perceptions and attitudes about the IWB use were studied looking at three main themes: instructional effects, motivational effects, and usability. The first theme is related with the effects of IWBs on teaching and learning processes and also addresses the advantages of IWBs. Similar to the results of previous IWB studies (Beeland, 2002; Moss et al., 2007; Erduran & Tataroğlu, 2009; Mathews-Aydinli & Elaziz, 2010; Saltan, Arslan, & Gök, 2010), it is apparent that teachers have positive perceptions (3.79/5.0) about the use of IWBs in general.

Focusing on IWB advantages, the seventh item has the highest mean score (M = 4.41, SD = .701). This item basically refers to the advantages relating to the visualization of course content. Teachers can design and use visually attractive materials compatible with an IWB; moreover, they can enhance their presentations, before or during instruction, with visual effects including highlighting, coloring, drawing, zooming, or can import visual objects from other sources (e.g., web-pages, Paint) via using screenshot or copy-paste feature (Türel, 2010). Wall, Higgins, and Smith (2005) suggest that such presentations help teachers to draw student attention to course content and also facilitate student retention of what they learned and facilitate student understanding of concepts (Levy, 2002). Those benefits are essential elements for students' learning; which may explain why teachers overwhelmingly agreed (77%) that they believed that using IWBs helps their students' learning (M = 4.16, SD = .904, see Q10 in Table 2).

The agreement level for the fifth question, 'IWB facilitates discussions on the content in class' (M = 3.30, SD = .954) reveals teachers' neutrality about IWB effect for class discussions. BECTA (2006) suggest that an essential IWB strategy would include using IWBs for initiating discussions about the course content. Teachers can use an IWB to share content for a class or a small group discussion. An IWB can be used for students to share their ideas in a discussion setting. Teachers are expected to improve their skills in terms of effectively using IWB strategies and, to promote their instructional activities based on the promises of IWBs (Beauchamp & Parkinson, 2005).

Teachers were asked the question: 'The way I give instruction has changed since I began to use an IWB (Q8)'. Almost half of the teachers agreed or strongly agreed (49.4%) to this statement (M = 3.45, SD = 1.011), which can mean that some level of pedagogical change may have occurred due to IWB technologies. Two items in the questionnaire are related to managerial issues of instruction: time management (Q1) and classroom management (Q3). According to the findings, most teachers believe that IWB provides time efficiency during instruction (M = 4.27, SD = .943). Likewise, researchers such as Levy (2002) and Tozcu (2008) suggest that using an IWB reduces the time spent recreating instructional materials and content since teachers have an electronic copy from the IWB were as they do not have an electronic copy with traditional boards. In addition, teachers can easily interact and communicate with students using an IWB and keep students engaged during a lesson. This is regarded as a major benefit of IWBs in terms of classroom management (BECTA, 2003). However, teachers who only present course content with an IWB in the same manner as a data projector may not give students an opportunity to sufficiently use it during instruction. Such kinds of teacher-centered practices may lead to a decrease in students' attention and motivation. Aligned with constructivist perspectives, teachers can encourage students to actively participate in the learning process by working on the IWB individually or in groups (Smith et al., 2005). However, the question, 'There is no time for my students to get around to using an IWB (Q6)' has the lowest mean score (M = 2.99, SD = 1.098). This indicates the possibility of a predominant teacher-centered modality in the classroom. However for effective teaching and learning, current studies (BECTA, 2003; Smith et al., 2005) maintain the importance of a student-centered modality using IWBs.

On the other hand, most teachers agreed that using an IWB is motivating, engaging, and enjoyable for both teachers and students. This finding is parallel with other studies (Bell, 2002; BECTA, 2003; Smith et al., 2005; Mathews-Aydinli & Elaziz, 2010). The lowest mean for motivational effects theme was the statement: 'My students look forward to my using an IWB in class (Q21)' (M = 3.08, SD = 1.074). Teachers' moderate responses to this question may result from students' willingness to use the IWB themselves or could be attributed to the decrease of students' initial enthusiasms towards IWB use more formally referred to as the novelty effect (Levy, 2002; BECTA, 2003).

Another key finding is that most teachers (75.9%) strongly agree that they are aware of the continuous improvement of their IWB skills (Q17) (M = 3.90, SD = .861). This finding indicates that one of the key sources for teachers IWB skill development is coming from their own experience as shown in Figure 2. Furthermore, teachers agreed on the importance of learning to use an IWB (Q18) (M = 4.06, SD = .856) by reporting how valuable the IWB is for their instruction.

For the usability theme, teachers were asked to indicate whether IWBs can be used in different contexts and ways. It is evident that teachers' perceptions regarding to usability of IWBs in any kind of course and course content are positive (Q24) (M = 3.90, SD = 1.080). Three quarters of the teachers agreed that IWBs can be used with various instructional methods and techniques (Q26) (M = 3.95, SD = .830). These findings suggest that IWBs are not tied to a specific context. Teachers who participated in this study have positive attitudes about the usefulness and usability of IWBs. These attitudes are essential indicators in terms of the acceptance and the prediction of effective use of this technology, as outlined by Davis's (1989) model.

Similarly, the frequency and the duration of technology use are other essential indicators for the acceptance of technology. Several significant differences were found in this study regarding the frequency and duration of teachers' IWB use. Expectedly in this study, teachers who frequently used an IWB were more likely to have a higher level of IWB competency and more positive perceptions towards an IWB use as suggested by Moss et al. (2007). As Glover et al. (2007) stated, 'teachers need time to develop their technological fluency, apply pedagogic principles to the available materials or to the development of materials, and then to incorporate the IWB seamlessly into their teaching' (p. 17). Therefore, encouraging teachers to use an IWB more frequently may help them 1) to effectively integrate the IWB in their instructions, 2) to have more positive attitudes towards IWBs, 3) to accept this technology as an effective and a helpful instructional tool, and also 4) to cope with the emerging issues of IWB use as competent users. This finding also confirms the importance of teachers' individual efforts to achieve higher-level IWB skills and knowledge as emphasized in the findings regarding the source of IWB skills and knowledge.

Concerning teachers' effective use of any technology, several issues are associated with each other such as acquiring appropriate skills and knowledge, perceived efficiency, and usage frequency of the technology. Even after a comprehensive IWB training session, teachers who do not sufficiently use an IWB and do not practice what they have learned may have lost their initial IWB skills and knowledge as well as their confidence over time (Slay, Siebörger, & Hodgkinson-Williams, 2008). Hall and Higgins (2005) emphasize that teachers need continuous training sessions to improve and also maintain such skills. It is clear that teachers in this study need training particularly on using effective instructional strategies for IWB-assisted courses in order to transform their pedagogy into more student-centered, social and interactive learning. However, there are two existing problems: 1) one time training sessions provided by the representative of IWB supplier are superficial, and 2) schools do not have the time and budget to provide regular training sessions. As such, teachers should be supported to continuously use IWBs in their classrooms by working with their peers in order to improve their IWB skills and knowledge as suggested by Shenton & Pagett (2007). Furthermore, effective IWB implementations shared by groups of teachers may increase the awareness of teachers in terms of effective IWB strategies as well as their positive attitudes towards using the IWB in their courses. Teachers can find just-in-time solutions to their IWB problems. These kinds of practice help teachers to quickly overcome the wow barrier that Beauchamp and Parkinson (2005) stressed as a breakpoint to achieve a profound impact of the IWB on instruction.

Limitations

This study, which represents a snapshot of IWB use, has several limitations that may provide guidance for future research. For example, a qualitative analysis would be helpful for the examination of the underlying reasons of significant differences emerging between the teachers who most and least frequently use IWBs in their classes. On the other hand, the questionnaire developed specifically for this study considering the existing literature and associated theories and models. This instrument may be exposed to confirmatory factor analysis to examine the fitness of themes with various fit-indexes (Anderson & Gerbing, 1988). Finally, similar research may be conducted by considering additional IWB factors such as issues of IWB-assisted courses and effects of receiving IWB trainings on the IWB use.

Conclusion

This study provides a solid example of IWB integration and IWB effects on the teaching and learning process, in a rapidly developing country. It should be noted that this work neither reflects the status quo of IWB use in general, nor investigates the challenges and technical issues of IWBs in Turkey. Rather, it attempts to uncover the more realistic effects of using IWBs for teaching and learning by recruiting active IWB users from various fields.

The findings from this study demonstrate the key characteristics and strategic requirements of effective IWB use based on the perceptions of teachers who were active IWB users. For better understanding and interpretation of teachers' perceptions, it is important to represent their background, as shown in this study, regarding IWB use including the frequency of IWB use, IWB competency, sources of IWB skills, and demographics. In general, participants were satisfied with the IWB use and they accepted IWBs as a powerful and practical technology that facilitates teachers' instructions as well as students' learning and motivation. However, findings indicate that teachers were not able to design a social constructivist environment where students could be involved in active and collaborative learning process using IWBs. Interestingly, most teachers believed that IWBs provided time efficiency for their instruction; however, a majority of them admitted that they could not find enough time to let their students use IWBs.

Results of the study also indicate a moderate correlation ($p < .05$) in the relationships between both the frequency of IWB use and perceptions about IWBs as well as the duration of IWB use and perceptions about IWBs. These variables are regarded as the key factors for effective use of technology. In addition, most teachers confirmed that their IWB skills were improved as they used the IWBs and stated that they learned IWBs mainly from their colleagues. Therefore, it seems critical to support teacher IWB collaborations.

It is expected that the findings of this study may help teachers and researchers who are interested in effective IWB use and also administrators who are responsible for integration of ICT or organizing IWB training sessions. IWBs have the potential to engage students' in various activities thereby supporting their learning and development. However if we are to expect students to improve their learning in the classroom, teachers need to develop their technology skills and positive attitudes though continued collaborative training and practice.

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